MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE.

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INTRODUCTION.

The MONTHLY WEATHER REVIEW for November, 1903, is based on data from about 3300 stations, classified as follows:

Weather Bureau stations, regular, telegraph and mail, 166; West Indian Service, cable and mail, 15; River and Flood Service, 52, river and rainfall, 177, rainfall only, 62; voluntary observers, domestic and foreign, 2565; total Weather Bureau Service, 2962; Canadian Meteorological Service, by telegraph and mail, 20, by mail only, 13; Meteorological Service of the Azores, by cable, 2; Meteorological Office, London, by cable, 8; Mexican Telegraph Company, by cable, 3; Army Post Hospital reports, 18; United States Life-Saving Service, 9; Southern Pacific Company, 96; Hawaiian Meteorological Service, 75; Jamaica Weather Service, 130; Costa Rican Meteorological Service, 25; The New Panama Canal Company, 5; Central Meteorological Observatory of Mexico, 20 station summaries, also printed daily bulletins and charts, based on simultaneous observations at about 40 stations; Mexican Federal Telegraph Service, printed daily charts, based on about 30 stations.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Mr. Curtis J. Lyons, Territorial Meteorologist, and Mr. R. C. Lydecker, Acting Territorial Meteorologist, Honolulu, H. I.; Señor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Camilo A. Gonzales, Director-General of Mexican Telegraphs; Capt. S. I. Kimball, Superintendent of the United States Life-Saving Service; Lieut. Commander W. H. H. Southerland, Hydrographer, United States Navy; H. Pittier, Director of the Physico-Geographic Institute, San José, Costa Rica; Commandant Francisco S. Chaves, Director of the Meteorological Service of the Azores, Ponta Delgada, St. Michaels, Azores; W. N. Shaw, Esq., Secretary, Meteorological Office, London; Rev. Josef Algué, S. J., Director, Philippine Weather Service; and H. H. Cousins, Chemist, in charge of the Jamaica Weather Office; Señor Enrique A. Del Monte, Director of the Meteorological Service of the Republic of Cuba.

Attention is called to the fact that the clocks and self-registers at regular Weather Bureau stations are all set to seventy-fifth meridian or eastern standard time, which is exactly five hours behind Greenwich time; as far as practicable, only this standard of time is used in the text of the REVIEW, since all Weather Bureau observations are required to be taken and recorded by it. The standards used by the public in the United States and Canada and by the voluntary observers are believed to conform generally to the modern international system of standard meridians, one hour apart, beginning with Greenwich. The Hawaiian standard meridian is 157° 30′, or $10^h\ 30^m$ west of Greenwich. The Costa Rican standard of time is that of San José, $0^h\ 36^m\ 13^s$ slower than seventy-fifth meridian time, corresponding to $5^h\ 36^m$ west of Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are sometimes corrected to agree with the eastern standard; otherwise, the local standard is mentioned.

Barometric pressures, whether "station pressures" or "sea-level pressures," are now reduced to standard gravity, so that they express pressure in a standard system of absolute measures.

FORECASTS AND WARNINGS.

By Prof. E. B. GARRIOTT, in charge of Forecast Division.

The marked features of the month were (1) the frequency of north Pacific coast lows, (2) the rapidity of storm movement, and (3) the cold wave of the 16–19th.

The forecasts and warnings were timely and as a rule accurate. The warnings issued in connection with the advance of the cold wave of the 16–19th over Texas and Louisiana were especially valuable to the sugar interests of those States. It is estimated that sugar cane to the value of $2,000,000 was cut in the thirty-six hours preceding the fall in temperature.

On the opening days of the month quiescent weather prevailed under the influence of an area of high pressure that had occupied the middle and eastern districts since October 27. On the night of the 2d, the official forecaster at the Central Office, Prof. E. B. Garriott, issued the following statement:

> Observation has shown that periods of low barometric pressure over the British Isles are attended by stagnated weather conditions over the western Atlantic and the eastern part of the American Continent, and that five to six days after reestablishment of normal barometric pressures over the eastern Atlantic, the usual progression of areas of high and low barometer over the United States is resumed. An instance of this kind has been presented during the past week. On Friday last an area of low barometer that had occupied the British Isles for several days began an eastward movement, and to-day the high barometer area that has persistently occupied the east-central part of the United States since last Tuesday shows signs of dissolution. The effect of these barometric changes will probably be shown in a gradual breaking up of the quiescent weather conditions that have prevailed since the 27th ultimo over the eastern part of the United States. There are at present, however, no indications of the development of a well-marked storm in the United States.

The p. m. reports of the 3d gave the first indications of renewed storm activity. A moderate depression then appeared off the Washington and Oregon coasts, and at the same time an area of high pressure began a southeasterly movement from Alberta. To the eastward of the last-named area, a shallow depression deepened somewhat and moved eastward, forming an elongated trough-like disturbance that passed off the Atlantic coast on the 5th. It was accompanied by general rains from the Mississippi Valley eastward and snows in the Lake region and northern portion of the Middle Atlantic States and New England.

In Washington the snow was the earliest noted since 1891, when snow fell on November 5. The average date of first snow in Washington is November 21, the earliest date October 14, 1876, and the latest date December 29, 1871.

The north Pacific coast storm of the 3d moved slowly inland and inaugurated a period of rainy weather in Washington and Oregon, that persisted with but few interruptions until the end of the month. Its movement eastward was very slow; it reached its maximum development on the morning of the 6th, with a barometer reading of 29.20 inches at Edmonton, and passed beyond the field of observation on the 7th. A second area of low pressure apparently developed over the Plateau

region on the morning of the 7th. It moved eastward to the Missouri Valley, where it was central on the morning of the 8th, thence northeasterly, passing over Lake Superior and down the St. Lawrence Valley, disappearing on the evening of the 10th over the Canadian Maritime Provinces.

On the 6th an energetic storm developed over the western North Atlantic. It reached its maximum strength on the morning of the 7th, with a barometer reading of 29.54 inches, and a maximum wind velocity from the northeast of 48 miles per hour on the Maine coast. This storm diminished in energy and passed eastward over the Atlantic Ocean from the 7th to the 10th.

From the 7th to the 10th the eastern districts were occupied by the area of high pressure that first appeared in Alberta on the evening of the 3d, and drifted slowly eastward, reaching the Lake region by the 6th. On the morning of the 10th pressure had fallen over the East and South, and a faint depression appeared off the North Carolina coast. This depression apparently moved northeastward over the Atlantic without affecting the coast districts.

On the 11th there began a series of extremely rapid barometric movements across the northern portion of the country. At that time an area of low pressure of considerable magnitude was central off the Washington coast, with a barometer reading of 29.00 inches at Tacoma. On the next morning this depression had moved to Iowa, a distance of about 1500 miles in twenty-four hours. On reaching Iowa, it curved northeastward, passing over Lake Superior on the evening of the 12th and disappearing north of that region on the morning of the 13th. On the evening of the 13th, a second North Pacific disturbance appeared off the Washington and Oregon coasts with a barometer reading of 29.50 inches at Portland. This storm increased in energy and was central on the morning of the 14th off the Washington coast, with lowest pressure, 29.30 inches, at Seattle. On the evening of that date, an offshoot of the main low appeared over northeastern Nevada, and in twelve hours it had moved to western Kansas. Its course was thence northeasterly, reaching lower Michigan on the morning of the 16th. Its rate of progression on the 16th, 17th, and 18th was greatly diminished, and it passed off the Atlantic coast on the last-named date as a trough-like depression, with barometer readings of 29.80 to 29.90 inches. The period of rapid movement was brought to a close by the southeasterly movement of an area of high pressure that first appeared on the morning of the 15th in Alberta. Zero temperatures, with snow, prevailed throughout Alberta and northern Montana, and the high spread southeastward and southward along the northern Rocky Mountain slope and over the eastern slope, reaching northern Texas by the morning of the 17th, and the Gulf coast and Ohio Valley by the morning of the 18th. By the morning of the 19th it had reached the Atlantic coast districts and northern Florida. Frost occurred on the Gulf coast and in northern Florida on the 19th, with minimum temperatures of 30° and 36° at New Orleans and Mobile, respectively, the lowest on record for the second decade of November. The pressures recorded in connection with the advance of this cold wave were remarkably high. A reading of 31.00 inches was recorded at Havre, Mont., on the morning of the 17th, and of 30.80 inches at Dodge City, Kans., on the morning of the 18th. The barometric reduction tables that have been in use since January 1, 1902, give sea-level pressure on the Plateau and in the Rocky Mountain regions that are probably two to three-tenths of an inch lower than those obtained in this case by using the Hazen tables. It is, therefore, impossible to make a direct comparison of the recorded barometric heights during the progress of the cold wave above noted with those that have previously occurred in the same regions. This high dominated the weather of the United States from the 16th to the 22d, although in the meantime an area of low pressure had advanced from the Oregon coast, where it was central on the 18th, to the Lake region, where it disappeared on the morning of the 22d.

The second series of rapid storm movement across the northern border began on the morning of the 23d. On the evening of the 22d a shallow depression covered Minnesota. This depression developed considerably during the night, and by the morning of the 24th it had moved to the lower St. Lawrence Valley, with lowest pressure, 29.42 inches, at Father Point and Quebec, respectively. It remained almost stationary over the Canadian Maritime Provinces during the 25th and gradually filled up during the next forty-eight hours.

A faint depression appeared on the morning map of the 24th, central over New Mexico. This depression moved slowly southeastward, and thence eastward along the Gulf coast, reaching Florida by the evening of the 25th, and disappearing over the Atlantic on the next day.

An area of high pressure that had been slowly moving southeastward from the eastern slope region, reached the Mississippi Valley by the evening of the 26th, and continued its southeastward movement during the 27th. It brought frost and freezing temperatures in the Gulf States and northern Florida on the mornings of the 27th and 28th. On the last-named date, minimum temperatures of 26° at Jacksonville, 32° at Tampa, and 36° at Jupiter were recorded. These values were as low, or lower, than any that had heretofore been recorded during the last decade of November.

The advance of lows from the North Pacific continued uninterruptedly until the end of the month. Pressure was low on the north Pacific coast and over British Columbia on the 25th and 26th. By the evening of the 26th it had fallen over the Missouri Valley, and by the evening of the next day a well-marked depression was central over western Minnesota. This depression increased in intensity during the next twelve hours and moved eastward, the southern end much faster than the northern, so that by the morning of the 29th, one center appeared off the Carolina coast and a second center over the northern portion of lower Michigan. The coast storm moved northeastward as an independent area of low pressure and the Lake region depression followed in its rear at a much slower rate of progression.

The winter type of high pressure over the Plateau region was established on the morning of the 26th and continued until the close of the month.

BOSTON FORECAST DISTRICT.

In many respects November was an ideal month, as there was a preponderance of fair weather, with fifteen clear days. The first half of the period was warm, while during the last half the temperature was below normal, making the monthly mean somewhat below the normal. The precipitation was decidedly deficient, except in extreme eastern Maine where it was about the normal. There were no severe or long-continued high winds, and, therefore, no damage and little delay to shipping. Storm warnings were displayed on the 5th, 7th, 11th, 15th, 24th, and 27th. No storms occurred without warnings.—*J. W. Smith, District Forecaster.*

NEW ORLEANS FORECAST DISTRICT.

The month was remarkable in some respects. Very little rain fell in any part of the district during the month; rain conditions appeared on the map several times, but they passed off without rain or only inappreciable amounts.

Unprecedented cold weather for the season of the year prevailed over parts of the district on the 18th and 19th. Cold-wave warnings were ordered for Oklahoma on the 16th and were extended to the Gulf coast during the 17th and 18th. Sugar planters and truck growers in Louisiana and Texas were warned on the morning of the 17th to prepare for tem-